nanosystec
PRECISION AUTOMATION

NanoHybrid

High-Precision Active Alignment, Test and Assembly Station

NanoHybrid

Versatile Active Alignment and Assembly

The NanoHybrid Station works with various assembly techniques such as precision gluing, micro laser welding and selective laser soldering with multiple laser optics under varying incidence angles.

Therefore, the station is ideally suited for research institutes, product development and manufacturing of challenging opto-electronic devices requiring multiple process steps.

The active alignment with nanometer precision is supported by advanced machine vision and sensor technology. Testing capability can be added as required. The versatile architecture with pre-configured building blocks provides greatest flexibility at a reasonable cost.

Assembly with Resin Dispensing and Gluing

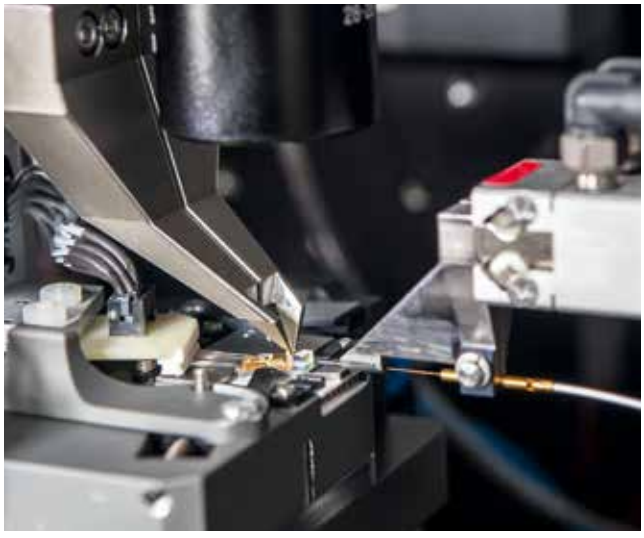
The automated dispensing of resin ranges from volumes of several nanoliters to milliliters (depending on the size of the devices and the bond gap). The constant volume is a significant factor for good and consistent quality of the finished product. Pre-dispensation and visual inspection of the dot size ensure high quality processes.

The vision system monitors the dispensing process and supports the precise positioning of the needle.

UV LED sources or arc lamps cure the resin within or after alignment and dispensing. In addition, thermal curing can be integrated.

High-Precision Motion System

The alignment stacks provide excellent performance for up to 6 motion axes covering all degrees of freedom. Long-travel linear motor axes serve for device pick-up and active alignment with down to 5 nm resolution, while rotary axes work with a common center of rotation and a resolution of 0.0005°.

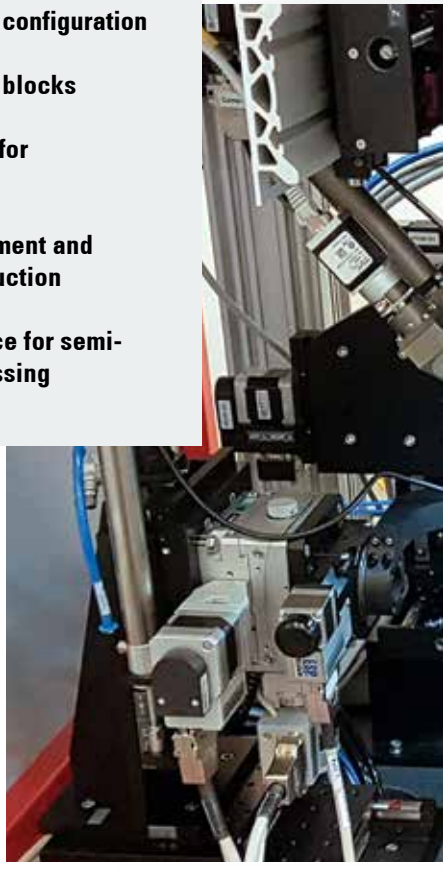


Two stacks with 6 axes each provide high-precision alignment with nanometer resolution. Advanced optics and machine vision ensure accurate passive pre-positioning before first light search starts.

The feedback signal can be optical power, polarization values, beam characteristics, wavelength – basically any measurement value generated from an optimum position after alignment. Automated alignment algorithms allow for repeatable results within a short process time.

Benefits of NanoHybrid

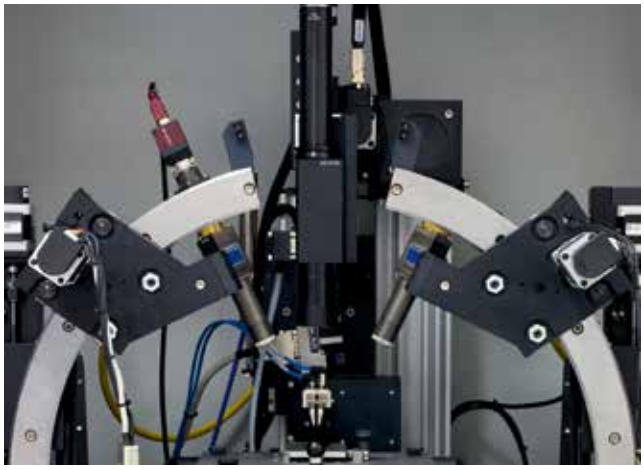
- **Active alignment with nanometer resolution**
- **High versatility of configuration**
- **Modular building blocks**
- **Extensive library for instrumentation**
- **Ideal for development and small serial production**
- **Easy user interface for semi-automated processing**



Durable Connections with Micro Laser Welding

Two or three laser optics serve for symmetrical conditions during the assembly of the parts. As an option, the incidence angle of the weld beams can be adjusted with motorized actuators.
The high-quality weld laser provides an accurate ratio between the beam paths and create equally sized spots. This balanced energy between the weld spots is a pre-requisite for low weld shift.

Additional grippers with force sensing capability handle auxiliary parts (such as weld clips) and avoid air gaps during the welding procedure.



NanoHybrid configuration with adjustable incidence angle and XYZ motion system for laser optics.

Selective Laser Soldering Capability

With selective laser soldering, the heated zone can be as small as 0.1 mm diameter while temperatures up to several 100° C are generated. The laser source generates a precisely controlled optical power and therefore a stable processing temperature. Temperature profiles with pre-configured heating and cooling ramps can be used as well as an active temperature control option.

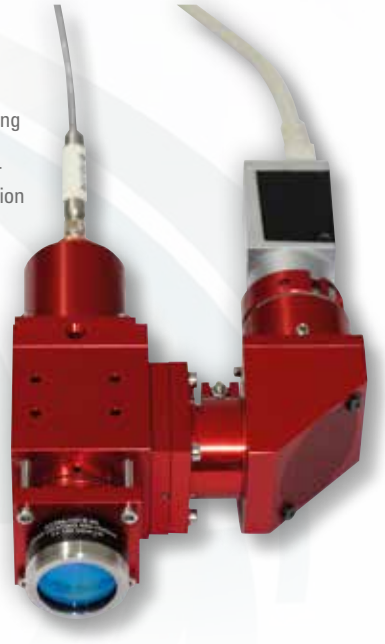
The electronics controls one or two solder heads. As for micro laser welding, the symmetrical introduction of the energy minimizes the shift especially for the assembly after a high-precision alignment in the sub-micron range.

NanoHybrid Station containing two alignment stacks with six axes each and force sensing, heated device nest, motorized zoom camera, two resin dispensers, UV LED for curing and micro laser welding.

Laser Optics with Camera Adapter

The laser optics for micro welding and selective laser soldering use CCD cameras which support image processing and exact positioning of the laser spots on the interface between the parts to be assembled. In addition, the pictures allow for visual inspection and quality control of the joints.

A CCD camera mounted on the focusing lens of the laser optics supports the image data processing and serves for the visual inspection and documentation of the laser joint.



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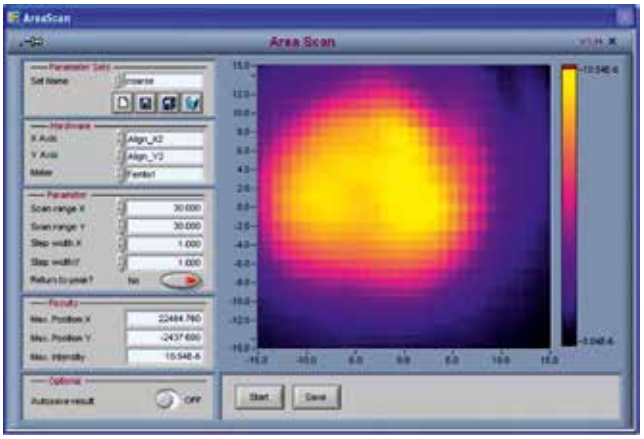
Device Characterization Capability

Besides the high precision alignment and assembly, the Nano-Hybrid offers various functions for device characterization of active and passive opto-electronic devices.

Beam evaluation is executed with CCD cameras as well as beam profilers – both in the visible and infrared range – or scan functions with the motion axes. In addition, M^2 value, near field and far field characteristics can be determined. Optical spectrum analyzers and wave meters measure and display the frequency properties.

LVI curves record the optical versus electrical values. Their mathematical calculation includes threshold determination, roll-over current and detection of kinks. Fast voltage sweeps allow for extinction ratio measurements on modulators.

Furthermore, the TestMaster software package offers functions for visual inspection by machine vision and surface mapping of the devices with distance sensors.



TestMaster provides characterization functions such as 2D scans which are useful to evaluate the device.

Versatile Software and Process Programming

The process software TestMaster serves as development and production solution with different user interfaces and access levels. Its file structure is process-oriented making it easy to run various device types or batch processes on the same system maintaining a clearly defined structure.

This powerful software package is the result of several decades of practical experience and continuous development. It is programmed in LabVIEW and all instruments and functions are organized in separate VI's. Additional functions or instruments can be integrated at any later point in time.

Besides the user interface with separate panels for all devices and functions, an easy to be programmed sequence editor controls all automated processes. It is organized in line code but does not require programming knowledge, just a clear understanding of the desired process.

For users who want to integrate their own LabVIEW programs, nanosystec offers a Software Development Kit which documents and defines common interfaces from the TestMaster. Programs written in MATLAB, Python or other languages can be called from TestMaster.

The operator interface for the automated processes is fully customized, e. g. to display important values as well as start and stop buttons for the desired process steps. This interface limits the user access during the automated process and reduces the complexity.

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